REMARKS

Claim 1 was pending and has been amended herein.

Claim 2-84 have been added. The added claims include no new matter.

Please charge any shortages and credit any overages to our Deposit Account No. 02-2666.

Respectfully submitted,
BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP

Dated: 10/16/02

Gregory D. Caldwell
Registration No. 39,926

12400 Wilshire Blvd.,
Seventh Floor
Los Angeles, CA 90025-1026
(503) 684-6200

Marked-Up Claim Amendments

1. (Once Amended) An apparatus comprising:

[a]means for receiving into a configurable programmed holographic structure comprising a plurality of diffractive elements, an input optical signal comprising a first spatial wavefront, the first spatial wavefront comprising a first wavefront shape and a first optical spectrum, the input optical signal further comprising a first direction of propagation;

[a]means for diffracting an input optical signal, producing a diffracted optical signal comprising an optical spectrum that differs from the input optical spectrum in at least one of amplitude and phase, the diffracted optical signal comprising a second direction of propagation that differs from the first direction of propagation;

[a]means for transmitting the diffracted optical signal, the diffracted optical signal comprising a second spatial wavefront that comprises a second wavefront shape, wherein the first and second spatial wavefronts are not identical in shape; and

[a] means for configuring the configurable programmed holographic structure.

2. A configurable programmed holographic structure comprising a plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, optical separation, and spatial phase, the configurable programmed holographic structure to interact with at least one input optical signal having a respective first spatial wavefront and a respective first temporal waveform, to produce at least one output optical signal having at least a respective second spatial wavefront and a respective second temporal waveform.

3. The configurable programmed holographic structure of claim 2, wherein the configurable programmed holographic structure further comprises a multiplexer.

4. The configurable programmed holographic structure of claim 2, wherein the configurable programmed holographic structure further comprises a de-multiplexer.

5. The configurable programmed holographic structure of claim 2, the plurality of diffractive elements comprising a cross-correlating transfer function.

6. The configurable programmed holographic structure of claim 5, the cross-correlating transfer function comprising a complex conjugate of a Fourier transform of a reference waveform packet.

7. The configurable programmed holographic structure of claim 6, the cross-correlating transfer function to cross-correlate a temporal code of the input optical signal.

8. The configurable programmed holographic structure of claim 7, the temporal code comprising binary code.

9. The configurable programmed holographic structure of claim 2 further comprising an optical packet decoder.

10. The configurable programmed holographic structure of claim 2, wherein the volume holographic structure is dynamically configurable.

11. The configurable programmed holographic structure of claim 10, dynamic configuration being effected by an electronic circuit comprising at least one conductive trace, the electronic circuit coupled to the configurable programmed holographic structure.

12. The configurable programmed holographic structure of claim 11, wherein the at least one conductive trace is at a potential difference relative to ground.

13 The configurable programmed holographic structure of claim 11, further comprising control logic, the configurable programmed holographic structure integrated on an integrated circuit.

14. The configurable programmed holographic structure of claim 10, the dynamic configuration effected by a plurality of electronic circuits comprising a plurality of conductive traces coupled with the configurable programmed holographic structure.

15. The configurable programmed holographic structure of claim 7, the dynamic configuration effected by modification of an index of refraction of at least one diffractive element.

16. The configurable programmed holographic structure of claim 2, the configurable programmed holographic structure operative to be re-configured from an initial configuration to a secondary configuration, so that a first output optical signal having a respective second spatial wavefront and a respective second temporal waveform when the configurable programmed holographic structure is configured in the initial configuration, differs in at least one of respective spatial wavefront and temporal waveform from a second output signal having a respective third spatial wavefront and a third temporal waveform when the configurable programmed holographic structure is configured in the secondary configuration.

17. The configurable programmed holographic structure of claim 16, the re-configuration effected by changing the spatial structure of at least one diffractive element.

18. A programmed holographic structure comprising a plurality of diffractive elements that comprise a cross-correlating transfer function, the plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, optical separation, and spatial phase, the programmed holographic structure interacting with an input optical signal comprising a first spatial wavefront and a first temporal waveform to produce an output optical signal comprising a second spatial wavefront and a second temporal waveform, the output optical signal comprising a product of the input optical signal and the cross-correlating transfer function.

19. The programmed holographic structure of claim 18 the cross-correlating transfer function comprising a complex conjugate of a Fourier transform of a reference waveform packet.

20. The programmed holographic structure of claim 19, the cross-correlating transfer function to cross-correlate the input optical signal comprising a temporal code.

21. The programmed holographic structure of claim 18 further comprising an optical packet decoder.

22. An apparatus comprising:

at least one input port operative to launch at least one input optical signal comprising an input spatial wavefront and an input temporal waveform;

a programmed holographic structure comprising a plurality of diffractive elements, the plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, spatial separation, and spatial phase, the programmed holographic structure to interact with the at least one input optical signal to produce a plurality of output optical signals, each output optical signal comprising a spatial wavefront that differs from the respective spatial wavefronts of all other output optical signals, each output optical signal comprising a respective temporal waveform, at least two of the output optical signals comprising temporal waveforms that differ from one another.

23. The apparatus of claim 22, the apparatus further comprising a multiplexer.

24. The apparatus of claim 22, the apparatus further comprising a de-multiplexer.

25. The apparatus of claim 22 further comprising a photodiode array configured to receive the plurality of output optical signals.

26. The apparatus of claim 25 further comprising support electronics for the photodiode array.

27. The apparatus of claim 26, wherein the apparatus is integrated onto a monolithic substrate.

28. The apparatus of claim 25, the photodiode array to extract data from the received output optical signals, and to output the extracted data.

29. The apparatus of claim 25, wherein the apparatus is integrated onto a monolithic substrate.

30. The apparatus of claim 22, each output optical signal comprising a temporal waveform differing from the temporal waveforms of all other output optical signals.

31. The apparatus of claim 22, the diffractive elements further comprising a cross-correlating transfer function.

32. The apparatus of claim 22, the diffractive elements further comprising a total cross-correlating transfer function, the total cross-correlating transfer function comprising a superposition of a plurality of cross-correlating transfer functions.

33. The apparatus of claim 22, wherein the programmed holographic structure is configurable.

34. The apparatus of claim 33, further comprising a plurality of output ports, the programmed holographic structure configurable to direct an input optical signal to at least one user-chosen output port.

35. The apparatus of claim 34, the programmed holographic structure configurable to direct an input optical signal to at least two of the output ports.

36. An apparatus comprising:

a configurable programmed holographic structure comprising a plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, optical separation, and spatial phase, the programmed holographic structure interacting with an input optical signal comprising a first spatial wavefront that comprises a first spatial wavefront shape and a first wavefront direction, the input optical signal further comprising a first temporal waveform, to produce an output optical signal comprising a second spatial wavefront that comprises a second spatial wavefront shape and a second wavefront direction, the output optical signal further comprising a second temporal waveform, the first and second spatial wavefronts differing in at least one of respective spatial wavefront shape and respective wavefront direction, and the first temporal waveform differing from the second temporal waveform; and

at least one conductive trace, the at least one conductive trace coupled with the configurable programmed holographic structure, to modify an optical characteristic of a diffractive element.

37. The apparatus of claim 36, wherein the optical characteristic is an index of refraction.

38. The apparatus of claim 36, wherein the optical characteristic is to be modified by an electro-optic effect.

39. A method comprising:

dynamically re-configuring a configurable programmed holographic structure comprising a set of optical characteristics, by introduction of energy to the configurable programmed holographic structure, thereby modifying at least one optical characteristic of the configurable programmed holographic structure so that, for an input optical signal interacting with the configurable programmed holographic structure, a first output optical signal which is output prior to dynamic re-configuration, the first output optical signal comprising a respective first spatial wavefront and a respective first temporal waveform, differs in at least one of spatial wavefront and temporal waveform

from a second output optical signal comprising a respective second spatial wavefront and a respective second temporal waveform, the second output optical signal to be output after dynamic re-configuring is effected.

40. The method of claim 39 wherein the energy introduced is at least one of electromagnetic, thermal, photonic, acoustic, nuclear, and chemical.

41. The method of claim 39, wherein the energy is supplied through a conductive trace, the trace coupled to the configurable programmed holographic structure.

42. The method of claim 39, wherein the modified optical characteristic is an index of refraction of a diffractive element.

43. The method of claim 39, the configurable programmed holographic structure further comprising a plurality of segments, each segment comprising at least one diffractive element, each segment comprising an average index of refraction.

44. The method of claim 43, wherein the modified optical characteristic is the average index of refraction of at least one segment.

45. The method of claim 43, each segment comprising a spatial structure.

46. The method of claim 44 the dynamic re-configuration effected by changing the spatial structure of at least one segment.

47. The method of claim 43, the configurable programmed holographic structure further comprising at least one gap comprising a material having a refractive index, the at least one gap situated between two adjacent segments, the energy introduced coupling with the at least one gap to effect dynamic re-configuration...

48. The method of claim 47, wherein the energy introduced is to change the refractive index of the material.

49. The method of claim 47, wherein the energy is supplied through at least one conductive trace coupled to the at least one gap.

50. The method of claim 43, wherein a segment comprises a plurality of sub-segments each of which comprises an index of refraction, and wherein the energy introduced coupling with at least one sub-segment is to effect dynamic re-configuration

51. An apparatus comprising:

means for receiving into a configurable programmed holographic structure comprising a plurality of diffractive elements, an input optical signal comprising a first spatial wavefront, the first spatial wavefront comprising a first wavefront shape and a first optical spectrum, the input optical signal further comprising a first direction of propagation;

means for diffracting an input optical signal, producing a diffracted optical signal comprising an optical spectrum that differs from the input optical spectrum in at least one of amplitude and phase, the diffracted optical signal comprising a second direction of propagation that differs from the first direction of propagation.

52. The apparatus of claim 51, further comprising:

means for providing the diffracted optical signal, the diffracted optical signal comprising a second spatial wavefront that comprises a second wavefront shape, wherein the first and second spatial wavefronts are not identical in shape.

53. The apparatus of claim 51, further comprising:

means for configuring the configurable programmed holographic structure.

54. The apparatus of claim 53, further comprising:

means for re-configuring the configurable programmed holographic structure.

55. A process comprising:

making a configurable programmed holographic structure comprising a configuration, on a monolithic substrate;

making an electronic device on the monolithic substrate, the electronic device coupled to the configurable programmed holographic structure, the electronic device to effect a change in the configuration of the configurable programmed holographic from a first configuration to a second configuration.

56. A product produced according to the process of claim 55.

57. A process comprising:

making a configurable programmed holographic structure comprising a configuration, on a monolithic substrate;

making an energy transfer device on the monolithic substrate, the energy transfer device coupled to the configurable programmed holographic structure, the energy transfer device to effect a change in the configuration of the configurable programmed holographic structure from a first configuration to a second configuration.

58. The process of claim 57, wherein the energy transfer device is to receive energy and transfer the energy to the configurable programmed holographic structure, the energy comprising at least one of electromagnetic, optical, thermal, acoustic, nuclear, and chemical.

59. A product produced according to the process of claim 57.

60. A process comprising:

making a configurable programmed holographic structure comprising a configuration, on a monolithic substrate;

making a thermal device on the monolithic substrate, the thermal device coupled to the configurable programmed holographic structure, the thermal device to effect a change in the configuration of the configurable programmed holographic structure from a first configuration to a second configuration.

61. A product produced according to the process of claim 60.

62. A process comprising:

making a configurable programmed holographic structure comprising a configuration, on a monolithic substrate;

making an optical device on the monolithic substrate, the optical device coupled to the configurable programmed holographic structure, the optical device to effect a change in the configuration of the configurable programmed holographic structure from a first configuration to a second configuration.

63. A product produced according to the process of claim 62.

64. A method comprising:

receiving at least one optical signal into a configurable programmed holographic structure comprising a plurality of output ports;

configuring the configurable programmed holographic structure to direct the at least one optical signal to at least one chosen output port;

directing the at least one optical signal to the at least one chosen output port; and

providing, at the at least one chosen output port, the at least one optical signal.

65. The method of claim 64, the configurable programmed holographic structure comprising a de-multiplexer.

66. The method of claim 64, the configurable programmed holographic structure comprises a multiplexer.

67. A configurable programmed holographic structure comprising:

a plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, optical separation, and spatial phase; and

a gap situated between two adjacent diffractive elements, the gap comprising a material having an index of refraction.

68. The configurable programmed holographic structure of claim 67, further comprising an energy delivery structure to receive energy, the energy delivery structure coupled with the gap to transmit energy to the gap, the material comprising the gap to change its index of refraction in response to energy received from the energy delivery structure.

69. The configurable programmed holographic structure of claim 68, the energy delivery structure comprising at least one conductive trace.

70. The configurable programmed holographic structure of claim 68, wherein the configurable programmed holographic structure is mounted on a monolithic substrate.

71. The configurable programmed holographic structure of claim 67, the configurable programmed holographic structure further comprising a plurality of segments, each segment comprising a plurality of diffractive elements, the gap situated between two segments.

72. A programmed holographic structure comprising a plurality of diffractive elements exhibiting a positional variation in at least one of amplitude, optical separation,

and spatial phase, further comprising a temperature compensation mechanism to thermally stabilize the programmed holographic structure.

73. The programmed holographic structure of claim 72, the temperature compensation mechanism comprising a temperature compensation reference patterned structure.

74. The programmed holographic structure of claim 73, the temperature compensation reference patterned structure to produce a reference signal.

75. A method comprising:

applying an energy in a time-varying manner to a configurable programmed holographic structure comprising a set of program characteristics, at least one of which varies with energy applied to the configurable programmed holographic structure, thereby varying the set of program characteristics in a time-varying manner;

receiving an optical signal into the configurable programmed holographic structure, the optical signal interacting with the configurable programmed holographic structure, producing a modulated optical signal that is modulated in a time-varying manner; and

providing the modulated optical signal at an output port.

76. The method of claim 74, further comprising applying the energy through a conductive trace which is coupled with the programmed holographic structure.

77. The method of claim 74, wherein the input optical signal interacts with the configurable programmed holographic structure to produce one of an optical signal encoded with multi-level phase shift key coding, and a multi-level phase shift key-decoded optical signal.

78. The method of claim 74, the programmed holographic structure further comprising a variable spatial structure, and wherein varying the set of program characteristics comprises varying the spatial structure.

79. The method of claim 74, the programmed holographic structure further comprising a gap situated between two adjacent diffractive elements, the gap comprising an index of refraction, and wherein changing a program characteristic further comprises changing the index of refraction of the gap.

80. The method of claim 74, the programmed holographic structure further comprising at least one segment, and wherein varying a program characteristic further comprises changing the index of refraction of the at least one segment.

81. A method comprising:

receiving an input optical signal into a configurable programmed holographic structure comprising a set of program characteristics and a proper operating wavelength range, the input optical signal interacting with the configurable programmed holographic structure;

directing the input optical signal to interact with the configurable programmed holographic structure, producing an output signal having an output power;

modifying the program characteristics of the configurable programmed holographic structure to maximize the output power, as measured by a power measurement device.

82. The method of claim 81 further comprising modifying the set of program characteristics by applying an energy to the configurable programmed holographic structure, for which at least one of the set of program characteristics varies with energy applied to the configurable programmed holographic structure.

83. A process comprising:

making a configurable programmed holographic structure on a monolithic substrate;

making an electromagnetic device on the monolithic substrate, the electromagnetic device coupled with the configurable programmed holographic structure to effect a change in the configuration of the configurable programmed holographic structure from a first configuration to a second configuration.

84. A product produced according to the process of claim 83.